- Disappointing Economic Performance. The trend growth in productivity and GNP has slowed during the 1980s, as discussed in Appendix B and in previous CBO reports. Any forecast that used the past as a guide to the future would therefore seem optimistic in retrospect. In fact, all major forecasters systematically overestimated GNP during the 1980s, although by slightly less than CBO. Mechanical time-series forecasts, which extrapolate past trends and cycles, would have tended to be even more optimistic than CBO. About $13 billion of the average deficit underestimate can be attributed to overestimating GNP.

- Unpredictable Components. Most of the remaining economic errors involve macroeconomic variables that are notoriously hard to predict. Overestimates of oil prices, for example, led to overestimates of windfall profit tax receipts averaging $4 billion. Since the windfall profit tax no longer produces significant revenues, this particular source of error should not recur. Overestimates of the corporate income tax base have been responsible for deficit errors of $5 billion, above and beyond the errors resulting from misestimating GNP. Errors in forecasting interest rates have caused large errors in the deficit estimates in certain years, but their average contribution has been small--that is, interest rates have been overestimated as often as they have been underestimated.

Errors in technical estimating assumptions--all of the errors that cannot be attributed to policy differences or inaccurate economic assumptions--are the smallest of the three sources of error, averaging $9 billion per year during the 1980s. Outlay estimates for farm price supports have been responsible for half of the technical errors, and errors in corporate income tax receipts for one-quarter. Apart from these two items, technical errors have generally been small and random.

CBO is carefully reviewing its estimating procedures in an attempt to minimize the economic and technical estimating errors identified in this analysis. Nevertheless, given the present size and variability of the American economy, budget deficits can never be forecast perfectly. A measure of the variability of the deficit estimate resulting from economic factors, the standard error, ranges from $36 billion to $44 billion. This means that the estimated deficit will differ by no more than $36 billion to $44 billion from the actual outcome about two-thirds of the time.

ANALYSIS OF BUDGET RESOLUTION ESTIMATES

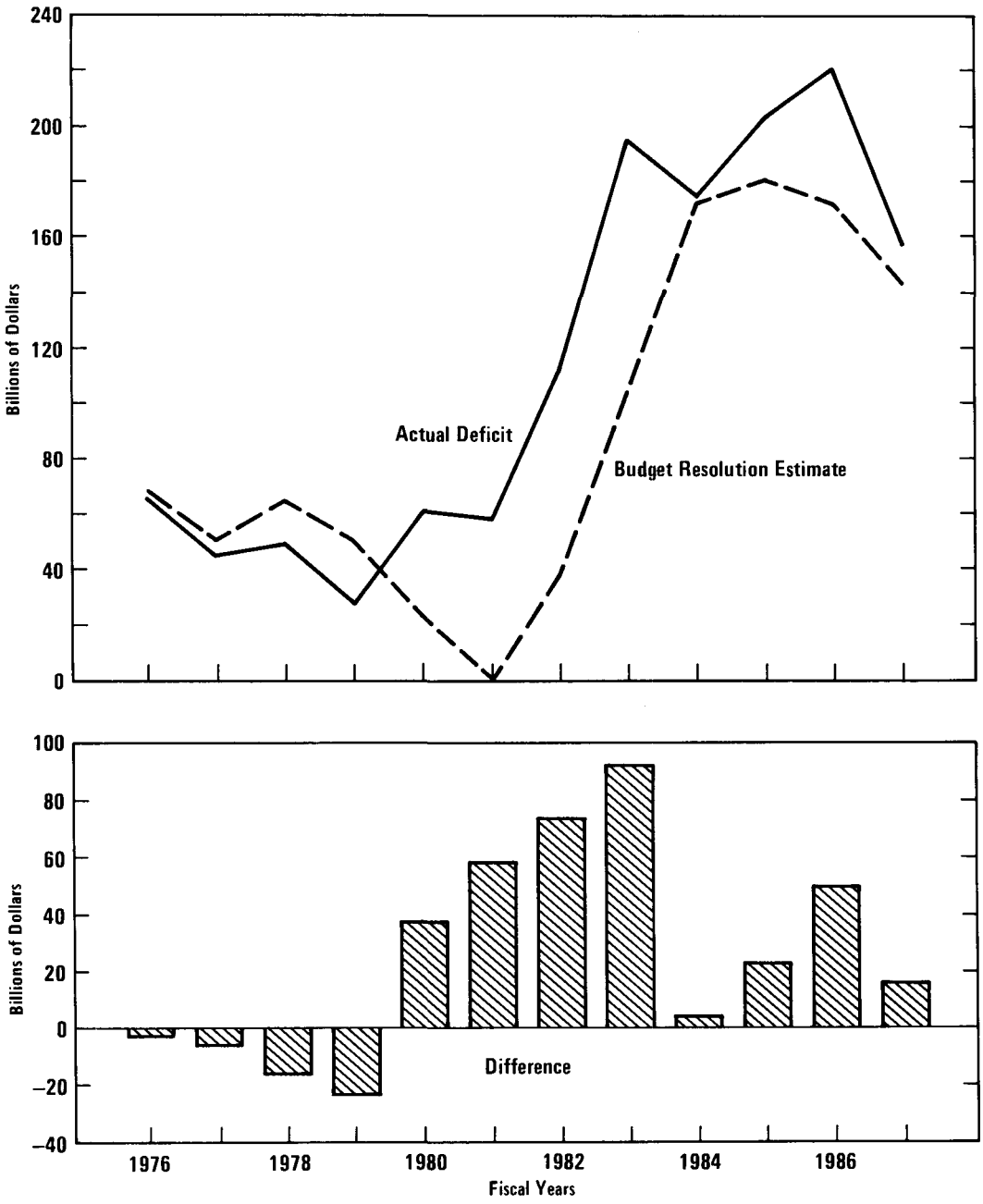
The uncertainty of budget projections has often frustrated Congressional attempts to cut the deficit. The level of frustration has been particularly high this year, as the Congress has struggled to meet the Balanced Budget Act's $144 billion target in the face of seesawing budget estimates. Estimates of the 1987 deficit swung from $143 billion in June 1986 to $161 billion in August, $151 billion in October, and $176 billion in February 1987.

The escalation of $33 billion in the deficit estimate in only eight months raised serious questions about the quality of the deficit projections. Critics contended that CBO had consistently erred on the side of optimism, and that the latest estimate was also too optimistic. Halfway into the fiscal year, many private-sector forecasters were projecting a 1987 deficit in the vicinity of $200 billion. While unexpected strength in tax collections has since reduced the deficit estimate to $157 billion and has muted the charges of bias, this chronicle provides further evidence of the uncertainty of the deficit estimates.

The concern over the accuracy of budget projections is not new. Soon after the Congressional budget process began, Senators Edmund Muskie and Henry Bellmon requested CBO to determine the reasons for the shortfall in federal budget outlays below the levels specified in the Congressional budget resolutions for 1977 and 1978. More recently, section 2905 (known as the Grassley Amendment) of the Deficit Reduction Act of 1984 (Public Law 98-369) directed CBO to study the nature and reliability of the assumptions upon which budget resolution estimates are based.

The first (and, since fiscal year 1986, the only) Congressional budget resolution is adopted in late spring or early summer. It is generally based on economic forecasts made the previous winter. The resolution is a plan for guiding spending and taxing decisions for the fiscal year beginning the next October. Subsequent authorization and appropriation action is required to turn the plan into law. In fiscal years 1976 through 1979, the actual deficit at the end of the year turned out to be less than the first budget resolution estimate. Since 1980, however, the actual deficit has consistently exceeded the planned amount. (See Figure III-2.)

Figure III-2.
Budget Resolution and Actual Deficits



SOURCE: Congressional Budget Office.

The budget resolution estimates are predicated on three types of assumptions:

- Policy assumptions, which specify the laws and administrative practices that are expected to apply--for some programs, those currently in force; for others, some proposed departure.
- Economic assumptions affecting revenues and spending; these include dozens of variables, but most importantly income and employment, inflation, and interest rates.
- Technical assumptions, which encompass all the remaining statistical and judgmental techniques used to turn the policy and economic assumptions into budget estimates.

Table III-1 divides the differences between the budget resolution estimates for fiscal years 1980-1987 and the actual outcomes into those resulting from policy, economic, and technical assumptions. The actual budget totals have been adjusted where necessary to agree with the budgetary treatment of various items in the budget resolutions (see Appendix A). Differences in debt-service costs, which are not directly controllable, are attributed to the three sources of error in proportion to each one's contribution to the deficit misestimate. All figures in the table are CBO staff estimates based on Budget Committee reports and other information. The analysis for 1987 is preliminary and is based on CBO's current estimates of revenues, outlays, and the deficit; the actual figures will not be known for another two months. No detailed analyses of first budget resolutions are available for fiscal years 1976-1979, because in those years more attention was given to the second budget resolutions.

Policy, economic, and technical assumptions have all contributed to recent underestimates of the deficit, as Table III-1 shows. Over the past eight years, the deficit has exceeded the budget resolution estimate by an average of $44 billion. Of this amount, $12 billion resulted from policy differences, $23 billion from inaccurate economic assumptions, and $9 billion from inaccurate technical assumptions. The average difference may be considered a measure of bias. A positive or negative average difference indicates that the actual outcome tended to exceed or fall short of the budget resolution estimate.

Another summary measure of accuracy is the average absolute difference between estimates and outcomes (the average of the dollar errors ignoring whether the errors were positive or negative). This is a measure of uncertainty. It shows the average annual amount of error, regardless of

direction, resulting from each source of difference. The total average absolute difference is usually less than the sum of the component parts, because the individual differences in any year may not all be in the same direction and thus may partly offset each other. The average absolute difference in deficit estimates resulting from policy assumptions was $18 billion, that

TABLE III-1. SOURCES OF DIFFERENCES BETWEEN ACTUAL BUDGET TOTALS AND FIRST BUDGET RESOLUTION ESTIMATES FOR FISCAL YEARS 1980-1987 (In billions of dollars)

	1980	1981	1982	1983	1984	1985	1986	1987 a/	Average Difference	Average Absolute Difference
Revenues										
Policy Assumptions	6.2	-3.7	13.0	-4.6	-13.7	-0.2	-1.5	19.2	1.8	7.7
Economic Assumptions	8.4	5.0	-51.9	-58.0	4.5	-20.0	-23.0	-29.3	-20.5	25.0
Technical Assumptions	-3.5	-12.6	-1.1	-2.7	-3.9	3.3	-2.1	10.7	-1.5	5.0
Total Differences	11.1	-11.2	-40.0	-65.3	-13.1	-16.8	-26.6	0.5	-20.2	23.1
Outlays										
Policy Assumptions	19.6	24.5	1.2	17.6	1.5	22.8	14.2	6.8	13.5	13.5
Economic Assumptions	12.4	6.4	24.1	0.5	7.1	-5.2	-12.1	-12.2	2.6	10.0
Technical Assumptions	15.6	16.0	7.7	8.1	-18.0	-12.9	20.1	20.8	7.2	14.9
Total Differences	47.6	46.9	32.9	26.2	-9.4	4.8	22.2	15.4	23.3	25.7
Deficit										
Policy Assumptions	13.4	28.2	-11.8	22.2	15.2	23.0	15.7	-12.4	11.7	17.7
Economic Assumptions	4.0	1.4	76.0	58.5	2.7	14.8	10.9	17.1	23.2	23.2
Technical Assumptions	19.1	28.6	8.8	10.8	-14.1	-16.2	22.2	10.2	8.7	16.2
Total Differences	36.6	58.1	73.0	91.5	3.7	21.6	48.8	14.8	43.5	43.5

SOURCE: Congressional Budget Office. For the Congressional budget resolution estimates and actual budget totals, see Appendix A.

a. The figures for 1987 are preliminary and are based on CBO's current estimates of revenues, outlays, and the deficit.

resulting from economic assumptions $23 billion, and that resulting from technical assumptions $16 billion. The next three sections of the chapter more thoroughly explore the three sources of error.

POLICY DIFFERENCES

Policy differences are not the main focus of this chapter, because they do not represent deficiencies in economic forecasting or budget estimating. In drafting a budget resolution, the Budget Committees must make assumptions about the timing and likely effects of future tax legislation, spending proposals, and administrative procedures. If the laws enacted differ from those assumed, the resolution estimates will be inaccurate. To a much lesser extent, unanticipated regulatory and other administrative actions by federal agencies can also cause unexpected changes in spending. Legislative and administrative actions have consistently increased the deficit relative to that assumed in the budget resolution (see Table III-2).

Over the past eight years, on average, actual tax policies have differed from those assumed in the budget resolutions by less than $2 billion, although there have been notable differences in a few years. In 1982, the Economic Recovery Tax Act cut taxes $13 billion less than assumed, leading to higher-than-projected revenues. In 1984, on the other hand, revenues fell $14 billion short of the level assumed, because of delays in enacting what was to become the Deficit Reduction Act. The 1987 budget resolution assumed revenue increases of $5.9 billion above existing law. Actual tax increases totaled $25.1 billion, exceeding the assumption by $19.2 billion. This excess resulted from the Tax Reform Act, which was not assumed in the 1987 budget resolution. The remaining revenue increases resulted primarily from improving tax enforcement activities, extending Superfund taxes, and speeding up certain excise tax payments.

Differences in spending policies have caused outlays to exceed the targets by an average of $14 billion. In two years (1982 and 1984) the amount of additional spending was $2 billion or less. But in two other years (1981 and 1985) the increase was more than $20 billion. The reasons for overspending have varied from year to year. In 1980 and 1981, the bulk of the increases were in defense and nondefense discretionary spending, which are subject to the annual appropriation process. Subsequently, the overruns have resulted primarily from underestimates of the spending implications of new entitlement laws, such as farm price supports. In addition lower offsetting receipts were realized because of failed legislative initiatives and unexpected administrative actions. Of the $23 billion in extra spending in

TABLE III-2. POLICY DIFFERENCES BETWEEN ACTUAL BUDGET TOTALS AND FIRST BUDGET RESOLUTION ESTIMATES FOR FISCAL YEARS 1980-1987
(In billions of dollars)

	1980	1981	1982	1983	1984	1985	1986	1987a/	Average Difference	Average Absolute Difference
Revenues	6.2	-3.7	13.0	-4.6	-13.7	-0.2	-1.5	19.2	1.8	7.7
Outlays										
National defense	5.9	4.5	-3.9	2.6	-0.7	0.9	-0.8	0.7	1.2	2.5
Entitlements										
Farm price supports	0.8	0.3	-1.7	1.7	--	2.6	5.8	3.3	1.6	2.0
Medicare	1.8	1.3	-0.1	1.6	0.3	--	0.4	-1.6	0.5	0.9
Social Security	-1.3	-0.2	5.1	-0.4	--	-0.1	--	--	0.4	0.9
Unemployment compensation	1.8	1.4	--	5.9	1.3	0.2	-0.1	b/	1.3	1.3
Public housing financing	--	--	--	--	1.0	13.9	0.9	--	2.0	2.0
Means-tested programs	1.8	0.8	-0.1	1.1	-0.3	--	-0.3	b/	0.4	0.6
Other	0.1	3.5	-0.2	b/	0.3	0.2	0.1	0.7	0.6	0.6
Subtotal	6.9	7.1	3.1	9.9	2.7	16.8	6.8	2.5	7.0	7.0
Nondefense discretionary	5.8	9.9	1.1	5.7	-2.0	1.2	2.3	2.4	3.3	3.8
Net interest										
Debt service	0.8	2.3	-1.7	1.0	0.7	1.2	0.9	-0.4	0.6	1.1
Other	--	0.4	0.9	-3.2	b/	b/	-1.7	--	-0.4	0.8
Subtotal	0.8	2.7	-0.8	-2.2	0.7	1.3	-0.9	-0.4	0.1	1.2
Offsetting receipts	0.1	0.3	1.7	1.6	0.8	2.6	6.7	1.5	1.9	1.9
Total	19.6	24.5	1.2	17.6	1.5	22.8	14.2	6.8	13.5	13.5
Deficit	13.4	28.2	-11.8	22.2	15.2	23.0	15.7	-12.4	11.7	17.7

SOURCE: Congressional Budget Office

a. The figures for 1987 are preliminary.
b. Less than $50 million.

1985, for example, about $14 billion was contributed by the government's purchase of federally guaranteed public housing authority notes, whose tax-exempt status was called into question by the Deficit Reduction Act of 1984. Another $3 billion resulted from unanticipated administrative action to make advance deficiency payments to farmers on their 1985 crops. Farm price supports also contributed $6 billion of the $14 billion in extra spending in 1986, as the Food Security Act of 1985 cost more than the legislation assumed in the budget resolution. In addition, offsetting receipts fell $7 billion short, because legislation to release disputed Outer Continental Shelf funds produced less in additional receipts than assumed, and bills to obtain oil overcharge funds and sell Conrail were not enacted.

In 1987, policy differences from the budget resolution added $6.8 billion to outlays. National defense and nondefense discretionary spending together exceeded the budget resolution by $3.1 billion. Changes in entitlement programs increased outlays by $2.5 billion on balance. Administrative changes in the farm price support program--primarily instituting a paid land diversion program for feed grains and making some payments in generic crop certificates--added $3.3 billion, while Medicare legislation saved $1.6 billion more than the resolution assumed. Lower offsetting receipts contributed $1.5 billion to the increase in outlays, primarily because of the failure to recoup from the states $1.2 billion in oil overcharge funds. Finally, by reducing the deficit, policy actions in 1987 cut debt-service costs by $0.4 billion.

ERRORS IN ECONOMIC ASSUMPTIONS

Federal budget outlays and revenues are tied closely to the state of the economy. The overall level of economic activity and the shares of income going to various sectors--wages and salaries, corporate profits, and proprietors' and interest income--largely determine the revenue collected by the federal government. Spending for benefit programs such as unemployment compensation and Social Security is affected by the rates of unemployment and inflation. The burgeoning federal debt means that assumptions about interest rates are now more critical than ever before in federal budget projections.

Budget Resolution Economic Assumptions

The Congressional Budget Act requires that the conference report on the budget resolution set forth the economic assumptions upon which it is based.

Normally, the conferees specify the following major macroeconomic variables: nominal and real gross national product, the unemployment rate, consumer price inflation, the three-month Treasury bill rate, wages and salaries, and corporate profits. In six of the eight years considered here, the conferees used CBO or modified CBO economic assumptions; Administration assumptions were used for fiscal years 1982 and 1986. CBO then uses its statistical and other estimating techniques to project the levels of personal income taxes, corporate income taxes, interest payments on the debt, unemployment benefits, and all the other components of revenues and outlays consistent with the specified economic and policy assumptions. (In a few cases, the conferees have chosen to diverge from CBO technical estimating methods as well as from CBO economic assumptions.) Over the 1980-1987 period, inaccurate economic assumptions have caused the actual budget deficit to exceed the budget resolution estimates by an average of $23 billion, of which about $20 billion per year has resulted from a shortfall in revenues (see Table III-3). The effect of inaccurate economic assumptions on outlays has been small on average, although sizable in certain years.

Revenues. The $20 billion average economic error in revenue estimates can be viewed in three parts--$4 billion from windfall profit taxes on oil companies, $9 billion from corporate income taxes, and $7 billion from other taxes (primarily individual income taxes and social insurance contributions). Significant errors in windfall profit tax estimates, which previously arose from inaccurate forecasts of oil prices, should not recur, since corporations will incur only minor liabilities unless oil prices rise well above currently projected levels. The economic errors in the other revenue estimates can be explained largely by errors in the assumed level of nominal GNP. These errors were greatest in 1982 and 1983, as the budget resolutions first failed to foresee the recession and then missed the timing of its trough. But GNP was also overestimated in 1985, 1986, and 1987.

Table III-4 reports the results of regression equations relating the economic differences between actual revenues and those assumed in the budget resolutions to the differences between actual and assumed GNP. For revenues other than those from corporate profits and windfall profits, the two errors are almost strictly proportional. (The constant term in the regression is not statistically significant.) A $100 billion error in the GNP assumption for the fiscal year will cause the estimate for this category of revenues--dominated by individual income taxes and social insurance contributions--to err by $17 billion.

Economic errors in corporate profits taxes are also related to errors in GNP, although in a more complex fashion. According to the second equation

in Table III-4, an error of $100 billion in assumed GNP will cause an error of $6 billion in estimated corporate profits taxes. Even if the assumed level of GNP proved exact, however, corporate profits taxes would fall short of the estimate by $5.3 billion per year for other economic reasons. This constant term reflects a tendency toward optimism in economic assumptions other

TABLE III-3. ECONOMIC DIFFERENCES BETWEEN ACTUAL BUDGET TOTALS AND FIRST BUDGET RESOLUTION ESTIMATES FOR FISCAL YEARS 1980-1987
(In billions of dollars)

	1980	1981	1982	1983	1984	1985	1986	1987a/	Average Difference	Average Absolute Difference
Revenues										
Individual income	4.4	10.8	-13.1	-18.5	5.3	-7.2	-11.6	-4.4	-4.3	9.4
Corporate income	2.8	-4.4	-13.8	-16.4	-4.7	-7.0	-6.6	-20.0	-8.8	9.5
Social insurance	-0.8	0.6	-10.8	-12.4	0.1	-3.9	-2.3	-1.8	-3.9	4.1
Windfall profits	--	-5.4	-14.2	-8.4	-1.1	-0.7	-2.8	-2.1	-4.3	4.3
Other	2.0	3.4	--	-2.3	4.8	-1.2	0.3	-1.0	0.8	1.9
Total	8.4	5.0	-51.9	-58.0	4.5	-20.0	-23.0	-29.3	-20.5	25.0
Outlays										
Entitlements										
Medicare	0.5	0.1	-0.2	-0.8	-0.3	--	--	--	-0.1	0.2
Guaranteed student loans	0.4	0.8	0.2	-0.5	0.8	-0.5	-0.5	-0.4	b/	0.5
Indexed retirement and disability programs	3.7	1.3	-1.5	-1.9	--	0.5	-1.9	-1.4	-0.1	1.5
Unemployment compensation	1.3	-0.2	5.2	3.3	-5.8	1.7	b/	-0.1	0.7	2.2
Medicaid, Food Stamps, and public assistance	0.8	0.6	1.1	0.4	-0.3	-0.2	-0.5	-0.3	0.2	0.5
Other	--	0.4	--	0.1	-0.1	--	0.1	b/	0.1	0.1
Subtotal	6.7	3.0	4.9	0.6	-5.6	1.4	-2.8	-2.2	0.7	3.4
Nondefense discretionary	--	0.1	0.1	0.1	0.3	b/	b/	-0.1	b/	0.1
Net interest										
Interest rates	5.5	2.8	12.4	-4.2	12.3	-7.9	-10.3	-11.3	-0.1	8.3
Debt service	0.2	0.6	6.7	4.0	0.2	1.3	0.8	1.1	1.9	1.9
Subtotal	5.8	3.4	19.1	-0.2	12.5	-6.6	-9.5	-10.2	1.8	8.4
Offsetting receipts	--	--	--	--	--	--	0.3	0.3	0.1	0.1
Total	12.4	6.4	24.1	0.5	7.1	-5.2	-12.1	-12.2	2.6	10.0
Deficit	4.0	1.4	76.0	58.5	2.7	14.8	10.9	17.1	23.2	23.2

SOURCE: Congressional Budget Office

a. The figures for 1987 are preliminary.
b. Less than $50 million.

than GNP that affect corporate profits tax estimates. A major explanation for this result is that the budget resolutions have systematically overestimated the share of corporate profits in national income. Also, the budget resolution forecasts have misestimated the amount and composition of new business investment and consequent depreciation allowances.

In total, an error of $100 billion in the estimate of nominal GNP (or about 2 percent of current levels) will lead to an error of $23 billion in estimated revenues. Not by coincidence, the ratio of the two numbers is close to the ratio of total taxes to GNP.

Outlays. Inaccurate economic assumptions have caused outlay underestimates averaging $3 billion; the average absolute error is $10 billion per year. Net interest has been the category of spending most affected by inaccurate economic assumptions, with an average absolute difference of

TABLE III-4. EQUATIONS RELATING ECONOMIC DIFFERENCES BETWEEN ACTUAL AND ESTIMATED REVENUES TO DIFFERENCES BETWEEN ACTUAL AND ASSUMED GROSS NATIONAL PRODUCT

Economic Difference in	Coefficient on		$\bar{R}^2$
	Constant	GNP Difference	
Revenues, Excluding Corporate Profits and Windfall Profits Taxes	2.5	0.17	0.86
	(0.9)	(6.6)	
Corporate Profits Taxes	-5.3	0.06	0.47
	(-2.3)	(2.7)	

SOURCE: Congressional Budget Office.

NOTE: The equations are estimated using budget resolution assumptions for fiscal years 1980 through 1987. T-statistics (shown in parentheses) measure whether a coefficient is statistically different from zero. R^2 is a measure of the regressions ability to explain the variation in the dependent variable.

$8.3 billion resulting from erroneous interest rate forecasts. As the federal debt has grown rapidly during the 1980s, outlays have become increasingly sensitive to interest rates. At the start of 1980, federal debt held by the public amounted to $645 billion; by 1987 it had almost tripled to $1.9 billion. At mid-decade the federal government was borrowing about $200 billion a year in new money and was refinancing about $600 billion a year of its existing marketable debt. Interest rates during the 1980s have also been more volatile than in the preceding decades. In 1980, 1981, and 1982 interest rates sometimes changed by more than one percentage point from one week to the next. In more recent years, week-to-week changes of one- or two-tenths of a percentage point are common.

Because debt financing locks the Treasury into current interest rates for some time, errors in assumed interest rates in both the budget year and the prior year affect the accuracy of the interest outlay estimates. As noted in Chapter II, erring by one percentage point on interest rates for the budget year affects outlays by about $5 billion. Erring by one percentage point for the prior year would affect outlays by another $5 billion.

Errors in the budget resolutions' net interest projections as a result of inaccurate interest rate assumptions ranged from underestimates of $12 billion in 1982 and 1984 to overestimates of more than $10 billion in 1986 and 1987. While in this case the uncertainty is large, the bias, as reflected in the average difference, was negligible. Errors in other economic assumptions, by causing the deficit to exceed the estimates, have added $1.9 billion per year to debt service costs, as shown in Table III-3.

After net interest, unemployment compensation is the spending program whose estimates have been most affected by inaccurate economic assumptions, with an average absolute difference of $2.2 billion. Failure to anticipate the 1981-1982 recession resulted in a $5 billion underestimate of unemployment insurance outlays in fiscal year 1982, while unexpectedly strong growth led to a $6 billion overestimate in 1984. As with interest, the uncertainty exceeds the bias, since the average difference shows an understatement of only $0.7 billion per year.

CBO Economic Assumptions

The Congress may choose to base the budget resolution either on the CBO economic forecast or on some alternative. In 1982 and 1986, Administration forecasts were used. Had CBO estimates been used in those two years, the average error in the deficit estimates resulting from economic assumptions would have been about $2.5 billion less, but still over $20 billion.

While CBO's recent forecasts have proved optimistic in retrospect, so did most other contemporary forecasts. Forecasts generated by mechanical time-series models would also have erred in the same direction, and by larger amounts. This tendency toward optimism results largely from the decline in the growth of productivity described in earlier CBO reports. This section compares the CBO forecasting record with that of other forecasters and with mechanical methods

Comparisons of economic forecasts with each other and with actual data are difficult to make because each forecast contains several variables. The accuracy of the forecast will differ for different variables, and all variables are not equally important with respect to their effects on the budget projections. As discussed above, however, the assumed level of the gross national product (in current dollars) has far more effect on revenues and the deficit than any other single economic variable.

In Table III-5, therefore, a comparison is made between the GNP forecasts of the Congressional Budget Office, the Office of Management and Budget (OMB), and several private forecasters--Chase Econometrics, Data Resources, Inc. (DRI), and Wharton Econometric Forecasting Associates (WEFA). The table shows the level of the GNP forecast in January for the upcoming fiscal year and also the percentage error of the forecast. It also shows the percentage error of a forecast produced by a mechanical time-series procedure, in which GNP is predicted solely on the basis of its own history. The use of time-series predictions for evaluating forecasts is common, because a forecast that is defensible statistically and at the same time detached from the subjectivities of human forecasters is felt to provide a good benchmark for evaluating other forecasts. (The data sources, the time-series models, and the procedures used here are summarized in Appendix A.)

For each of the forecasts, Table III-5 shows the mean percentage error (the average of the percentage errors for the individual years) and the mean absolute percentage error (the average of the percentage errors ignoring whether the errors were positive or negative). These figures may be taken as measures of bias and uncertainty, respectively, like the summary measures shown on the earlier tables of budget estimates. If CBO has been unduly optimistic, for example, one would expect to find its mean percentage error to be higher than the mean error of the other forecasts and the time-series model.

76-050 - 87 - 3

No firm conclusions can be drawn on the basis of only 10 observations (the number of years for which there are data on CBO errors). The sample is just not large enough to distinguish systematic errors from random ones. Nevertheless, the table suggests the following:

TABLE III-5. BUDGET YEAR GNP FORECASTS AND ERRORS (By fiscal year)

Fiscal Year	Actual a/	CBO	OMB	CHASE	DRI	WEFA	Mechanical b/
			Forecasts in Billions of Current Dollars				
1978	2,044.8	1,987.0	2,038.4	1,953.2	2,011.1	2,030.2	1,956.1
1979	2,313.1	2,247.9	2,274.6	2,222.7	2,245.8	2,270.4	2,238.4
1980	2,521.4	2,515.1	2,505.7	2,436.6	2,475.7	2,460.6	2,538.6
1981	2,856.5	2,767.3	2,764.4	2,738.1	2,785.7	2,760.5	2,853.3
1982	3,031.2	3,211.1	3,191.8	3,220.0	3,204.9	3,232.4	3,167.4
1983	3,228.4	3,424.1	3,433.6	3,462.5	3,428.8	3,448.4	3,515.5
1984	3,581.2	3,498.8	3,488.7	3,532.7	3,509.3	3,530.5	3,501.9
1985	3,834.6	3,910.0	3,890.1	3,883.0	3,849.8	3,901.5	3,761.8
1986	4,163.4	4,158.2	4,198.5	4,139.7	4,086.1	4,150.4	4,212.3
1987	4,406.8	4,503.7	4,538.1	4,432.6	4,401.8	4,467.1	4,605.6
			Percentage Errors (Forecast Minus Actual as a Percent of Actual)				
1978		-2.8	-0.3	-4.5	-1.6	-0.7	-4.3
1979		-2.8	-1.7	-3.7	-2.9	-1.8	-3.2
1980		-0.2	-0.6	-3.4	-1.8	-2.4	0.7
1981		-3.1	-3.2	-4.1	-2.5	-3.4	-0.1
1982		5.9	5.3	6.2	5.7	6.6	4.5
1983		6.1	6.4	7.3	6.2	6.8	8.9
1984		-2.3	-2.6	-1.4	-2.0	-1.4	-2.2
1985		2.0	1.4	1.3	0.4	1.7	-1.9
1986		-0.1	0.8	-0.6	-1.9	-0.3	1.2
1987		2.2	3.0	0.6	-0.1	1.4	4.5
			Summary Statistics				
Mean Percentage Error							
1978-87		0.5	0.9	-0.2	c/	0.7	0.8
1980-87		1.3	1.3	0.7	0.5	1.1	1.9
Mean Absolute Percentage Error							
1978-87		2.8	2.5	3.3	2.5	2.7	3.2
1980-87		2.7	2.9	3.1	2.6	3.0	3.0

SOURCES: Forecasts are those for the budget year as constructed in late January of the previous calendar year. Forecast series for CBO and OMB were obtained from unpublished quarterly forecast tables. Other institutional forecasts were obtained from published reports. See Appendix A.

a. The actual series consists of the estimate published by the Commerce Department in the first November following the close of the respective fiscal year. For 1987, the latest available forecasts of CBO, OMB DRI, and WEFA were averaged.

b. This is the average of 42 univariate autoregressive forecasts. See Appendix A.

c. Less than 0.5 in absolute value.

- The patterns of errors are similar for CBO and the other forecasts. During the 1980s, all of the forecasts overestimated GNP on average. Moreover, all of the forecasts tended to err in the same direction each year. The errors were especially large in 1982 and 1983, around the trough of the recession.

- No single forecaster has consistently proved best. The forecaster having the smallest error in one year sometimes has the largest error the next.

- The size of the mean percentage error depends critically on the years being examined. For example, CBO's mean percentage error is 1.3 percent for 1980-1987 but only 0.5 percent if 1978 and 1979 are added to the calculation.

- The uncertainty of the estimates, as estimated by the mean absolute percentage error, is much more stable across forecasters and across years than is the mean percentage error.

- Compared with the private forecasts, the accuracy of CBO's forecasts is mixed. CBO's mean percentage error during the 1980s is higher than that of the three private forecasts, although probably not by a statistically significant amount. Its mean absolute percentage error, however, is less than two out of three.

- Compared with the unbiased mechanical forecasts, the CBO forecasts were not optimistic at the time they were made. In retrospect, they did prove too optimistic, because the economy grew at a rate below the historical trend.

As discussed in Appendix B and in previous CBO reports, the trend growth in productivity and GNP has slowed during the 1980s. Since all recent forecasts have tended to overestimate GNP, it seems reasonable to attribute the forecast errors to a general failure to anticipate the change in the underlying trend and not to any bias on the part of the forecasters. In fact, CBO, OMB, and the private-sector forecasters have performed slightly better than the mechanical forecasts, which merely extrapolated recent history.

ERRORS IN TECHNICAL ASSUMPTIONS

All errors in budget projections that do not fit one of the previous categories are classified as technical. Budget estimates would be imprecise

even if their policy and economic assumptions were completely borne out. On the revenue side of the budget, technical errors can result, for example, from erroneous assumptions about the timing of realizations of capital gains or the amount of contributions to tax-deferred retirement arrangements. Similiarly, in making spending projections, no one can predict exactly how many eligible people will apply for Social Security benefits next year or how fast the Department of Defense will spend its appropriations. Some of the technical assumptions are really subsidiary assumptions about the economy--for example, assumptions about agricultural exports and commodity prices, which affect spending for farm price supports.

Technical errors caused the first budget resolution to underestimate the actual deficits by an average of $8.7 billion per year--$1.5 billion from lower revenues and $7.2 billion from higher outlays (see Table III-6). The average absolute errors are $5.0 billion for revenues (less than 1 percent) and $14.9 billion for outlays (less than 2 percent).

Of the $8.7 billion average technical error, about one-half ($4.4 billion) results from underestimating outlays for farm price supports, while about one-quarter ($2.0 billion) comes from overestimating corporate income tax receipts. There have also been relatively large errors in estimating national defense outlays and individual income tax revenues in several years, but over time these errors have canceled out. They have not contributed significantly to the average underestimate of the deficit. Apart from these areas, technical estimating errors have generally been small and random.

Revenues

Corporate income taxes are the only revenue source that has been regularly overestimated for technical reasons--by an average of $2.0 billion per year. Not surprisingly, they also show a large average absolute technical estimating error--$3.2 billion, or about 5 percent of collections. Of the major categories of revenues, corporate taxes are by far the most erratic--both in dollar terms and as a percent of GNP. Corporate profits taxes even vary substantially as a fraction of economic profits--for example, falling from 31 percent of profits in fiscal year 1982 to 20 percent in 1983.

Individual income tax estimates have about the same average absolute technical difference as corporate income taxes. In relation to collections, however, the average absolute difference is much smaller--less than 1 percent. Over the 1980-1987 period, individual income taxes have been underestimated by an average of $1.4 billion for technical reasons, although the average error would be negligible if the 1987 experience were excluded

TABLE III-6. TECHNICAL DIFFERENCES BETWEEN ACTUAL BUDGET TOTALS AND FIRST BUDGET RESOLUTION ESTIMATES FOR FISCAL YEARS 1980-1987
(In billions of dollars)

	1980	1981	1982	1983	1984	1985	1986	1987 a/	Average Difference	Average Absolute Difference
Revenues										
Individual income	5.7	-3.1	0.1	3.0	-0.5	b/	-3.7	10.0	1.4	3.3
Corporate income	-8.5	-1.8	2.2	-1.1	-2.5	2.4	-2.3	-4.7	-2.0	3.2
Social insurance	0.2	-2.4	-0.5	-1.0	-0.1	1.5	1.7	1.6	0.1	1.1
Other revenue sources	-0.9	-2.3	1.0	0.3	-0.8	-0.6	2.1	3.8	0.3	1.5
Unallocated by source	--	-3.0	--	-3.9	--	--	--	--	-0.9	0.9
Accounting change	--	--	-3.9	--	--	--	--	--	-0.5	0.5
Total	-3.5	-12.6	-1.1	-2.7	-3.9	3.3	-2.1	10.7	-1.5	5.0
Outlays										
National defense	5.2	1.4	2.7	-4.6	-11.9	-12.4	7.0	0.6	-1.5	5.7
Entitlements										
IMF, exchange stabilization fund and FMS trust fund	-0.3	0.7	0.4	-1.3	0.1	-0.8	-3.0	-0.3	-0.6	0.9
Farm price supports	-1.7	2.3	11.0	10.6	-1.2	2.4	10.3	1.2	4.4	5.1
FDIC and FSLIC	1.3	0.7	-0.8	1.0	1.4	0.2	2.7	6.0	1.6	1.8
Medicare and Medicaid	0.9	4.0	3.8	0.9	-4.0	0.3	1.8	2.9	1.3	2.3
Social Security	-0.9	-1.1	-1.7	2.0	1.1	-0.5	-0.2	-0.7	-0.3	1.0
Unemployment compensation	1.0	-0.3	-0.1	-2.6	-3.0	-0.4	0.3	0.8	-0.5	1.1
AFDC, SSI, and EITC	0.7	1.0	b/	-0.2	1.1	1.1	0.8	1.1	0.7	0.8
Other	0.7	3.1	-0.1	2.3	-0.2	-0.1	0.1	2.4	1.0	1.1
Subtotal	1.7	10.3	12.5	12.6	-4.6	2.1	12.7	13.5	7.6	8.8

(Continued)

SOURCE: Congressional Budget Office.

a. The figures for 1987 are preliminary.
b. Less than $50 million.

from the calculation. Technical errors in estimates of social insurance contributions have been extremely small. The average difference between the estimates and the results is only $0.1 billion. The average absolute difference is $1.1 billion, or about 0.4 percent of collections.

76-050 - 87 - 4

TABLE III-6. (Continued)

	1980	1981	1982	1983	1984	1985	1986	1987	Average Difference	Average Absolute Difference
Nondefense discretionary	9.2	5.2	-4.8	-2.5	-2.9	-2.0	-6.0	-2.2	-0.7	4.4
Net interest										
Debt service	1.2	3.1	b/	-0.1	-2.5	-1.4	0.6	1.0	0.2	1.2
Other	-0.1	0.6	-3.7	-3.5	1.1	2.2	3.5	2.8	0.4	2.2
Subtotal	1.1	3.7	-3.6	-3.6	-1.4	0.9	4.0	3.8	0.6	2.8
Offsetting receipts										
Timber and mineral receipts	-0.2	0.2	1.3	1.6	0.7	0.2	0.2	0.5	0.6	0.6
OCS receipts	-1.2	-5.1	3.5	3.9	1.7	-0.8	3.2	2.6	1.0	2.8
Other	-0.2	0.3	b/	0.6	0.4	-0.8	-1.1	0.9	b/	0.6
Subtotal	-1.6	-4.6	4.8	6.1	2.7	-1.5	2.2	4.0	1.5	3.4
Accounting change	--	--	-3.9	--	--	--	--	1.0	-0.4	0.6
Total	15.6	16.0	7.7	8.1	-18.0	-12.9	20.1	20.8	7.2	14.9
Deficit	19.1	28.6	8.8	10.8	-14.1	-16.2	22.2	10.2	8.7	16.2

Of the $1.5 billion average overestimate of total revenues, $0.9 billion results from ad hoc adjustments to the revenue targets made by the budget resolution conferees in 1981 and 1983. Another $0.5 billion is attributable to a 1982 accounting change, which affected revenues and outlays by equal amounts and had no effect on the deficit. Neither of these errors represents a deficiency in estimating procedures.

Outlays

The largest technical errors in spending estimates have arisen in national defense and in farm price supports. Both programs have experienced average absolute differences in excess of $5 billion. Defense spending estimates have erred in both directions, and the measure of bias, the average error, has been only $1.5 billion, less than 1 percent of defense outlays. Farm price support estimates, on the other hand, have understated actual spending

by an average of $4.4 billion, or about one-third of program costs. This difference in the relative accuracy of the estimates derives in large part from differences in the ways the two programs operate.

National defense spending is controlled by annual appropriations, which give the Defense Department authority to contract for goods and services. Cash outlays arise, however, only when the goods and services are actually produced or delivered. Outlay differences that result from differences between the actual appropriation and that assumed in the budget resolution are classified as policy differences. Differences that result from misestimating the rate at which the appropriations result in outlays are labeled technical.

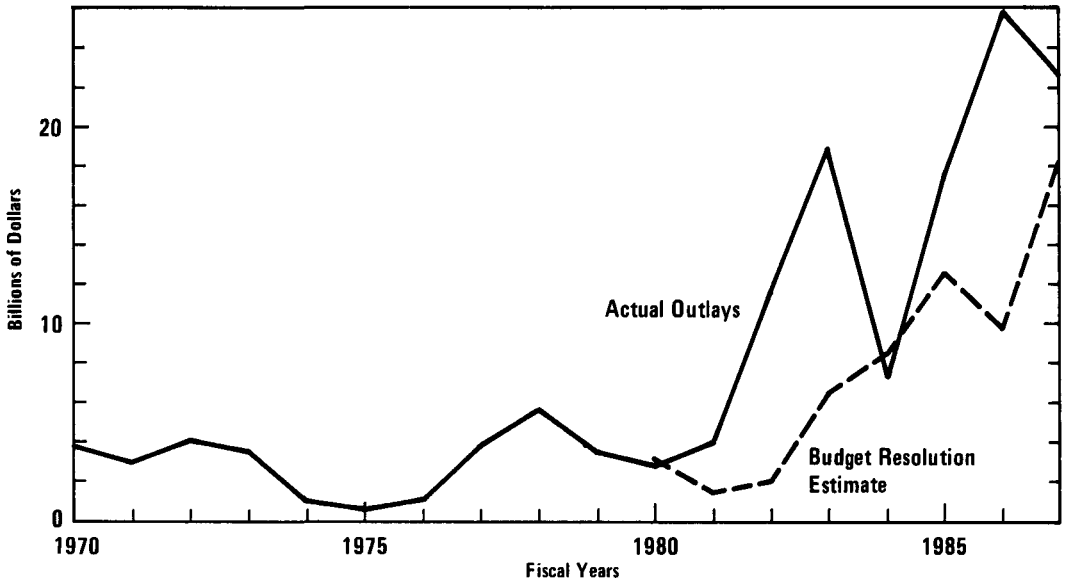
In some cases, notably in the budget accounts for the services of the military and civilian personnel of the government, the outlays occur almost entirely in the year for which the budget authority is appropriated. In other instances--for example, procurement of major weapons systems, such as ships, tanks, or aircraft--the outlays are spread over several years. CBO estimates outlays for each national defense budget account by applying spendout rates that reflect the historical rates at which appropriations have resulted in outlays. Since most appropriations eventually result in outlays (although a small amount lapses and is never spent), errors in assumed spendout rates are unlikely to cause persistent errors in outlay estimates. If spending is misestimated in one year as a result of an incorrect spendout rate, there is likely to be an offsetting error in a later year. In the eight years for which data are available, defense outlays have been overestimated in three years and underestimated in five. The overestimates in 1984 and 1985 were particularly large, however, so that the average technical error in defense is an overestimate of $1.5 billion, or about one-half of 1 percent of current defense outlays.

The farm price support program is an entitlement program and is not controlled by the appropriation process. This means that all those who meet the eligibility criteria established by law and regulation are entitled to support, which is given through loans, commodity purchases, cash payments, and other means. Program outlays are therefore dependent on developments in the agricultural sector, such as domestic weather conditions, crop yields, foreign demand, and commodity prices. Not only are these factors difficult to predict, but the program has been significantly affected by changes in law or regulations almost every year. As a result, farm price support outlays have been extremely erratic, as pictured in Figure III-3. In forecasting any such series based on historical experience, there is a

tendency to underpredict changes, whether increases or decreases. Such has been the case with farm price supports. The average underestimate of $4.4 billion results primarily from missing the very large increases in 1982, 1983, and 1986.

Outlays for deposit insurance and the major health care entitlements have also tended to be underestimated for technical reasons, but by lesser amounts. The outlays of the two major deposit insurance funds (the Federal Deposit and the Federal Savings and Loan Insurance Corporations) have been understated by an average of $1.6 billion per year. The spending of these two agencies may rise by billions of dollars because of the failure of just one or two banks; moreover, the agencies have considerable discretion regarding the timing and form of assistance provided to troubled financial institutions. Medicare and Medicaid have had technical estimating errors averaging $1.3 billion per year, or a little over 1 percent of program outlays. Estimating outlays for these programs, as for farm price supports, has been complicated by frequent legislative and administrative changes designed to control the cost of the programs. In addition to the usual uncertainties about the rate of increase in medical care costs, caseloads, and utilization, it has been necessary to predict the response of health care providers to the new laws.

Figure III-3.
Farm Price Support Outlays



SOURCE: Congressional Budget Office.

UNCERTAINTY IN BUDGET ESTIMATES

The foregoing analysis has demonstrated that policy differences, inaccurate technical estimating methods, and inaccurate economic assumptions have all been a factor in underestimating the deficits during the 1980s. Policy differences may be reduced to the extent that the policies of the budget resolution are more fully implemented. Some reduction in the size of the technical differences may be possible, although this is already the smallest of the three sources of error But the inherent unpredictability of the economy will remain the greatest source of uncertainty in the budget estimates. There are at least two ways of quantifying this uncertainty. One is forward looking; the other backward looking.

The prospective approach uses a time-series model to estimate the uncertainty of GNP forecasts for fiscal year 1988. The model (described in Appendix A) recognizes random elements that will cause any one particular forecast to be somewhat too high or too low. The larger are these random shocks, the greater will be the average difference (whether positive or negative) between any single forecast of the model and the actual outcome.

Figure III-4 shows an estimate of the range of uncertainty surrounding CBO's January 1987 forecast of nominal GNP for fiscal year 1988. The distribution shown is the result of simulating the time-series model 5,000 times, but with different random shocks applied. The standard deviation of the forecasts--a statistical measure of the dispersion of the individual forecasts around the average--is $190 billion. Under assumptions detailed in the appendix, one can expect that about 68 percent of the time forecasts of GNP will differ from the actual GNP by less than $190 billion (one standard deviation). About 95 percent of the time, the forecasts will differ by less than $380 billion (two standard deviations).

This uncertainty range for GNP forecasts may be translated into an uncertainty range for revenue and deficit estimates. As discussed above, a $100 billion error in estimating the gross national product will tend to result in a $23 billion error in revenues. Thus, a $190 billion error (one standard deviation) in GNP corresponds to a $44 billion error in revenues. A range of plus or minus $88 billion would be required to encompass 95 percent of the revenue outcomes.

The retrospective approach employs the 1980-1987 data for economic errors displayed previously in Table III-3. Excluding windfall profits taxes, the root mean square error in revenue estimates resulting from economic